CALENDAR OF EVENTS
Scientific meetings Page 34

DECEMBER 24, 1984
CHEMICAL & ENGINEERING
NEWS

05117SC095 9 W AR0252SL 1
CONGRESSIONAL INFO SERV-SKI
4520 EAST WEST HWY SUITE 800
SKI ACQUISITIONS
BETHESDA MD 2031+

Monsanto R&D

Chief scientist Schneiderman leads vigorous research push

Page 6

CHEMICAL & ENGINEERING
NEWS

Volume 62, Number 52
CENEAR 62 (52) 1–48
ISSN 0009-2347

DECEMBER 24, 1984

News of the Week

■ **Cooperation through chemistry between industrialized and developing nations urged at congress of Pacific Basin countries.** **Page 4**

■ **Walter Gilbert resigns presidency of Biogen N.V.** **Page 5**

■ **Remainder of methyl isocyanate in Bhopal, India, plant converted to finished product; Congressman, NTSB urge stronger safety regulations.** **Page 5**

Business

Major U.S. chemical companies plan to raise capital spending 17% in 1985 following a mere 2% rise this year over 1983. **Page 16**

Government

Congressional hearing at Institute, W.Va., triggered by the Bhopal tragedy, examines hazards of living near chemical plants. **Page 19**

Company turns more than 3000 tons of state-government-labeled "dangerous waste" into high-quality pelletized fertilizer. **Page 21**

Science

Electron transfer in proteins can occur at biologically significant rates across 10 to 25 Å, three research teams find. **Page 24**

Books

"Newton at the Bat" and "SportScience" use different approaches to describe the role that science plays in sports. **Page 28**

Meetings

C&EN's semiannual calendar of events lists meetings of interest to chemists and chemical engineers during 1985. **Page 34**

Cover: Monsanto senior vice president for R&D Howard A. Schneiderman at St. Louis research lab

News Focus

Howard Schneiderman, vice president for R&D at Monsanto, discusses the company's new emphasis on R&D and how it will shape Monsanto's future. **Page 6**

Letters 2
Editor's Page 3

Concentrates
Business 14
Government 18
Science/Technology 23

The Departments
ACS Comment 30
Newscripts 48

Chemical Capital Spending To Climb Again in 1985

Major U.S. chemical firms plan to increase expenditures about 17% in 1985; outlays this year were up only 2% over the 1983 level

William J. Storck, C&EN New York

While many economists are crowing about the good state of capital spending in the U.S. economy, the chemical industry so far is not taking part. Spending in 1984 came in well below first estimates and, as a result, many chemical corporate planners are saying, "Wait until next year." And indications are that things will change next year.

Specifically, C&EN's annual survey of capital spending budgets at 14 leading U.S. basic chemical companies finds a rise of about 17% planned in 1985 from 1984 levels. This follows a preliminary 2% rise in 1984 from what spending was a year ago.

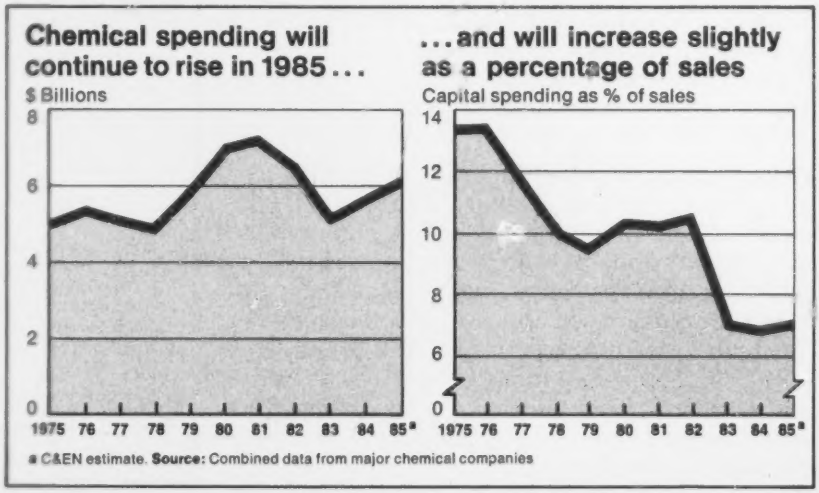
At this time last year, the same 14 chemical companies were predicting that spending on new plant and equipment in 1984 would rise 15% from what they had spent in 1983. However, a number of economic factors conspired to forestall this increase.

Although profits were up for chemical companies, it was accomplished mainly on production, and prices have not especially justified the cost of capital needed to build new plants. Even though production has increased, capacity utilization, except for some few specific chemicals, has not risen high enough to call for new capacity. According to the Federal Reserve Board, capacity use for chemicals and allied products is still only in the mid-70% range, well below levels needed to justify plant expansion. Though U.S. demand for chemical products has been fairly strong this year, U.S.-produced chemicals have faced increasing competition from imported materials, and U.S. exports of chemicals have been somewhat stifled by the strength of the dollar against foreign currency—a situation that has produced a malaise in U.S. merchandise exports in general.

In addition, the relatively high interest rates prevailing through much of the year have kept the cost of capital relative to expected rates of return on many chemicals too high to justify expansion. Thus, like 1983, this year saw much of the spending on new plant and equipment going to streamlining and modernization in an effort to maintain lower break-even points on products rather than going to building new plants.

The state of chemical capital spending has led some observers of the industry to become concerned about adequate capacity in the future. After the 1975 chemical recession, they say, there was a spate of plant building that led to overcapacity throughout much of the late 1970s. The industry appeared to have learned its lesson and after the most recent recession seemed to be very chary of building new plants. In fact, these observers say that the industry may be too timid; they believe that, given the lead time of two to three years to bring a new plant to completion, there could be either a shortage of some chemical products in a few years or the shortfall between demand and capacity will have to be made up by imports, thus shrinking still further the declining chemical trade surplus.

The problem is that most chemical economists see many of the same problems that affected the industry this year prevailing into next year. This means that, no matter what the companies are saying now, capital spending again may increase only moderately. And even if the companies surveyed by C&EN do raise spending an average of about 17%, it still will be well below the 20% pace of the 1970s, when capital spending was fueled by inflation and an unfailing sense of optimism.



a C&EN estimate. **Source:** Combined data from major chemical companies

Capital spending by major chemical firms will increase to $6.1 billion in 1985

$ Millions	1985		1984		Worldwide					Change from previous year	
	World	U.S.	World	U.S.	1984 planned[a]	1983	1982	1981	1980	1985	1984
Air Products	$ 325	$ 276	$ 263	$ 234	$ 300	$ 246	$ 347	$ 323	$ 364	23.8%	6.5%
American Cyanamid	200	150	185	139	190	165	171	181	196	8.1	12.1
Celanese	200	185	170	157	175	105	275	414	253	17.6	61.9
Dow Chemical	830	520	780	450	750	630	829	1176	1184	6.4	23.8
Du Pont[b]	1700	na	1200	na	1500	1276	1300	1420	1297	41.2	−6.0
Ethyl	116	110	86	83	95	85	92	141	156	34.9	1.5
W. R. Grace	420	340	336	267	450	353	560	657	658	25.0	−4.8
Hercules	210	168	200	150	200	168	174	167	229	5.0	19.0
Monsanto	575	523	575	523	600	560	673	668	781	0.0	2.7
Olin	170	165	160	155	175	123	139	186	172	6.3	30.5
PPG Industries	400	320	350	280	400	450	452	376	401	14.3	−22.2
Rohm & Haas	130	104	130	104	130	72	126	182	93	0.0	81.8
Stauffer Chemical	137	117	112	105	130	104	177	239	246	22.1	8.3
Union Carbide	650[c]	455[c]	650	455	775	761	1179	1186	1129	0.0	−14.6
TOTAL	$6063	$3433	$5197	$3102	$5870	$5097	$6493	$7316	$7159		
ANNUAL CHANGE[d]	16.7%	10.7%	2.0%	5.1%	15.2%	−21.5%	−11.3%	2.2%	23.5%		

a Earliest estimates. b Excludes Conoco. c C&EN estimates. d Cumulative change for companies reporting. na = not available.

Even at the beginning of this year, the feeling was that 1984 would take a hefty dose of capital spending—reflected in the 15% increase over 1983 levels planned by the 14 companies surveyed. Preliminary indications of 1984 spending show that it actually amounted to 11% below what had originally been budgeted.

This year, the increase in capital spending was headed by Rohm & Haas, with an 82% jump to $130 million. This was followed by Celanese, whose spending rose 62% to $170 million, and by Olin, with a 31% increase to $160 million. These big increases were offset partially, however, by declines of 22% at PPG Industries to $350 million, 15% at Union Carbide to $650 million, and 5% at W. R. Grace to $336 million.

Some surveys have found that capital expenditures for the chemical industry have increased faster than was found in C&EN's survey. A Conference Board study, for example, shows that capital spending for chemicals and allied products through the first three quarters of 1984 increased 18.4% to $8.31 billion. However, this is expenditures for the broad chemicals and allied products category and thus includes pharmaceuticals and other specialty products. C&EN's list of companies is dominated by basic chemicals.

On a constant-dollar basis, the New York City-based business research group's findings indicate that for the first nine months, capital spending for chemicals and allied products rose 18.2% to $4.26 billion in 1972 dollars, indicating very little construction inflation in 1984.

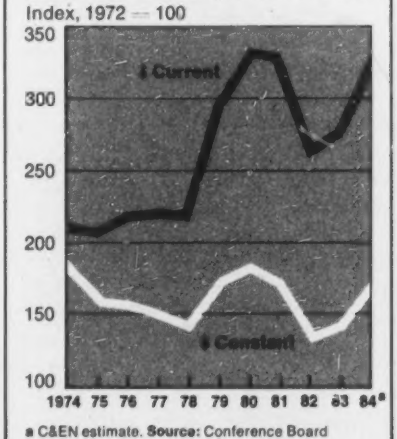
The 17% average increase in capital spending presently planned for next year cuts across most of the companies surveyed. All of the companies surveyed plan increases in 1985, with the exception of Rohm & Haas, Monsanto, and Union Carbide. These three companies intend to keep spending level with this year. Carbide's spending plans are uncertain, pending the outcome of the Bhopal, India, tragedy.

Du Pont (excluding Conoco) will be leading the increase next year, with a 41% jump to $1.70 billion, followed by Ethyl, with a 35% increase to $116 million; Grace, with a 25% rise to $420 million; and Air Products, with a 24% increase to $325 million.

Capital spending in the U.S. for the 13 companies reporting these data will increase 11%, slightly faster than their total spending at 9%. Once again about 78% of the spending by these companies will go to plants in the U.S.

Capital spending increases may even be higher over the next few years than the 17% increase for 1985 indicated by C&EN's survey. In addition to surveying capital spending, the Conference Board keeps track of capital appropriations for chemicals and allied products. These monies are what companies currently have appropriated to be spent in the future. The board's survey through the first nine months of this year shows that capital appropriations for chemicals and allied products are up 20% to $8.80 billion from the same period in 1983, indicating that possibly the next three years or more will be relatively good ones for the U.S. chemical industry in terms of new plants and equipment. □

Capital appropriations for chemicals jumped in 1984



a C&EN estimate. Source: Conference Board

Bhopal Disaster Spotlights Chemical Hazard Issues

At Institute, W.Va., hearing, government and industry re-examine environmental concerns of communities near chemical plants

Wil Lepkowski, C&EN Washington

The world of chemical technology may never be the same, even after public attention veers off from the tragedy at Bhopal, India. Union Carbide chairman Warren M. Anderson agrees. "We're going to have to re-evaluate everything," he told a Congressional hearing in Institute, W.Va., 10 days after the Bhopal disaster (C&EN, Dec. 17, page 6). Institute is the site of Carbide's unit for the production of methyl isocyanate, the chemical that killed at least 2500 persons in Bhopal.

After three weeks of anger, grief, soul searching, and official inquiry, it seems clear that Anderson's promise to look at "everything" will have to include a number of things. For one, evacuation plans for communities near chemical plants. Chemical companies have well-designed and rehearsed plans for preventing and acting on leakages within their plants. And they have siren systems that warn of serious leakages. But the communities themselves have only the scantiest of plans for evacuation procedures once the alarms are sounded. For example, it would make sense for residents of the Kanawha Valley in West Virginia, where Institute is located, to have access to quick rail or water transportation. No such measures exist.

Another area that needs examination is right-to-know laws. In the past, the chemical industry has opposed legislative efforts to tell surrounding communities what is being produced and stored in nearby chemical plants, even though there are worker right-to-know laws on the books.

There is the problem of pollutants from sewage treatment facilities. The Environmental Protection Agency thus far has refused to regulate the mixtures of volatile organic compounds—some carcinogenic—rising into the air from wastewater treatment facilities in chemical plants and in communities where such plants are located. At two Carbide plants, 1990 tons of waste chemicals were discharged into such treatment plants last year, and part of this was released into the atmosphere by aeration, according to Perry Bryant, deputy director of Citizen Action, a public interest group in Charleston.

Another is lowering the high cancer rates associated with chemical production. Some communities near chemical plants are considered cancer "hot spots." Public outcry over such data could rise.

Closing the loops and plugging the leaks by using more high-technology methods in chemical plants need a look. The industry has made substantial progress in reducing air pollutant emissions. It will have to do better. As West Virginia state health director L. Clark Hansbarger says, "The chemist is obviously going to have to be added to the engineering team in assessing safety and preventive illness activities. We are now going to be dealing with the micro-particle or molecular consistency of our environment, versus dust or haze."

Finally, there is the jurisdictional confusion between the Occupational Safety & Health Administration and EPA. OSHA and EPA will have to do a better job coordinating their functions where public and worker safety overlap. The methyl isocyanate leak that killed the thousands in Bhopal and any other such potential leaks in the workplace are violations that come under the jurisdiction of OSHA. Yet EPA so far is getting most of the heat for failing to list methyl isocyanate as a dangerous pollutant.

C&EN staff photo

Testifying at hearing in Institute, W.Va., are (from left) Carbide's plant manager Henry J. Karawan, chairman Warren M. Anderson, and director of health and safety Jackson B. Browning

"It's a terrible thing to think we have to have these tragedies to get industry to come forward and say, yes, maybe we should have thought these things through," declared Rep. Henry A. Waxman (D.-Calif.), chairman of the House Health & Environment Subcommittee that held the hearings. "On those areas—right to know, air emissions, and underground storage—it has not been the posture of the industry to be as accommodating as you [Anderson] are today. I'm hopeful you can share that attitude and try to induce the rest of the industry to be a little more forthcoming and not automatically be opposed to many of the initiatives."

Testimony from school teacher Donald Wilson underscored the kind of extreme, but measured, response the industry can expect in coming months from a concerned public. Wilson was describing his experiences during an atmospheric inversion in Institute. He reported several days of flu symptoms in himself and his students.

"I became alarmed because I knew that these experiences were taking place on such a magnitude and were not being reported," he said. "As fluid developed in our lungs we learned to sleep on an incline to keep from drowning in our own fluids. We have learned to stay inside when there is no wind and to keep plenty of moisture in the home.

"This is what you call the risk factor and this is what the risk factor means to me. I teach in Stonewall Jackson High School in the heart of the so-called 'cancer superblock.' I have watched our children come to school with arthritis, with cancer, with leukemia at a rate much higher than the national average. Only over the last few months have we heard any indication from so-called experts making reference to the studies that have been done in the area."

So the Kanawha Valley will be the place to watch over coming months for the combined response of industry, government at all levels, and the public as to the overall occupational and environmental health aspects of chemical exposure.

The fact is that several areas of the valley are not pleasant places to live, especially in winter. Skies are often overcast, the air is often still, mist settles like a napping cat over the landscape. The residents are staunch, loyal to their life-blood industries, and impressively open hearted. Few speak up, although statistics and anecdotal evidence show that their health and environment could be better.

Carbide's Institute plant emits major pollutants

Pollutant	Pounds per hour
Acetone	345
Acrylonitrile	38
Benzene	72
1,3-Butadiene	127
1,3-Dioxolopentadiene	99
Ethylene oxide	443
Formaldehyde	67
Hydroxyethylcellulose	69
Isopropanol	685
Kerosine	39
Methanol	133
2-Methylbutane	351
Methyl isocyanate	12
4-Methyl-2-pentanone	76
Nitrogen dioxide	12
Propylene oxide	252
Toluene	22

Basis: 1981 survey of major emissions from plant. Source: Occupational Safety & Health Administration

Admittedly, the Kanawha River itself is cleaner than it has been in 50 years. So is the air. The only vapors seen wafting up from the chemical plants appear to be steam. But as Bryant testified, the dangers now are even more insidious. The respiratory cancer rates in the valley are 50% higher than the national average, according to state health statistics. Sewage treatment, he said, is especially lax.

"The citizens of the Kanawha Valley, who are forced to assume the risk of storing chlorine, phosgene, methyl isocyanate, and other toxic substances within their community," said Bryant, "have no way whatsoever to obtain this information under existing law. Nor do they have any input into the decision to store superhazardous materials within their community. We find this to be an unconscionable situation, one that must be changed."

The West Virginia air pollution control law requires plants like Carbide's to list an inventory of toxic materials escaping from their facilities. For Institute, "this inventory indicates that there are hundreds of pounds of toxic gases that are leaking every day," said Waxman. "If that is accurate," he asked Anderson, "do you know whether those leaks are causing cancer, central nervous disorders, birth defects, or other dangers to the public health over a longer period of time?"

Anderson, of course, didn't have the answer. But he said industry is getting better at controlling leakages. If that's so, said Waxman, "you're doing it without knowing what is happening. We're being told on the one hand that it's a sealed system. But on the other, all these chemicals are leaking into the air on a routine basis. I find that troubling. The federal government doesn't know anything about it and that's outrageous enough. The state government hasn't the ability to regulate. We rely on you to regulate yourself. And if you are regulating yourself, it doesn't seem to me that your own people know why these chemicals are going into the air and what effect they're having on the public."

Anderson insisted he had "no objection" per se to any right-to-know law. "My concern is state-level right-to-know laws that confuse and complicate the issues. A federal right-to-know law that could be actively administered and [that] everyone understands and could be worked with makes sense," he said.

"If anything has come out of Bhopal," he continued, "it is the re-evaluation by government agencies, by industries themselves, what is it that we have, what is it that we need, how do we ensure against tragedies such as Bhopal. As I have said before, I never would have believed that this sort of thing could have happened. But it did. We don't know why. Maybe when we do, it will give us guidance and direction in which way we and a lot of other people should move.

"I don't know what the answers will be. I know that probably that the rest of my career will be involved in this kind of a discussion and resolution of issues." □